The magnetic current sensor uses the physics principle that current flowing through a conductor creates a magnetic b-field. Based on this principle, the TMCS1123 uses Hall-effect sensors that sense the amount of current that passes through the lead frame of the device and provide a proportional voltage output to an input current. Magnetic current sensors are isolated current-sensing designs – the TMCS1123 can support reinforced working voltages up to 1.1 kV\textsubscript{DC} and basic working voltages up to 2.0 kV\textsubscript{DC}. Hall-effect sensors are notorious for drifting across temperature and lifetime, manifesting as an output error. However, with Texas Instruments’ signal chain expertise, the TMCS1123 has the best-in-class drift parameters of 0.5% maximum over lifetime and temperature.

![TMCS1123 Functional Block Diagram](image)

**Design Considerations**

**What does TMCS1123 provide to a system?**

- Excellent voltage isolation characteristics with capabilities of 1.1 kV\textsubscript{DC} of reinforced isolation working voltage, 2.0 kV\textsubscript{DC} of basic working voltage, 5 kV\textsubscript{RMS} withstand isolation voltage, and 8.1 mm of creepage and clearance, allowing for safe usage in high-voltage systems.
- Industry-leading accuracy performance of 1.75% maximum total error from across temperature, lifetime, and other sources of error.
- Capability to carry continuous currents of 75 A\textsubscript{RMS} at 25°C and 40 A\textsubscript{RMS} at 125°C
- Active ambient field rejection of 0.1 A/mT, which significantly reduces magnetic interference from neighboring conductors or other sources of stray magnetic fields
- Fast response times with a fast overcurrent detection response of 500 ns, coupled with a device bandwidth of 250 kHz, supporting fast systems to enable precise control and monitoring. Higher bandwidth devices in development.
- The device is equipped with a precision reference voltage output to enable more precise conversion with analog-to-digital converters by creating a quasi-differential output.
- Unique to the TMCS1123 is the Alert output, which provides a thermal alert if the junction exceeds 165°C and a sensor alert if the sensitivity or offset is out of range of the factory limits.
<table>
<thead>
<tr>
<th>Part Number</th>
<th>Automotive Qualified</th>
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<tr>
<td>TMCS1123</td>
<td>Automotive version in development</td>
<td>1.1-kV&lt;sub&gt;DC&lt;/sub&gt; reinforced working voltage isolation, 500-ns overcurrent detection, Alert for device performance</td>
<td>75 A&lt;sub&gt;RMS&lt;/sub&gt;</td>
<td>Motor control, inverter and H-bridge current measurements, power factor correction, overcurrent protection, DC and AC power monitoring, EV charging stations</td>
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